



Improvement of the Reproductive Performance of Dairy cows During the Transition Period

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ABSTRACT:

The present study is a trial to improve the reproductive performance of dairy cows following the administration of an immune-stimulant prebiotic drug during the transition period. A total number of 30 dairy cows, 3-8 years old and 1-6 parities, were assigned into two comparable groups: 20 cows were taken Celmanax, as a immune-stimulant prebiotic drug, and 10 cows were left as control. The obtained results showed a non-significant reduction in the rate of retained placenta and the number of service/conception, significant shortness in time of uterine involution and the days open as well as improvement of the conception rate for the treated rather than for the non-treated dairy cattle. The serum IgG and IgM increased, while the serum Nitric oxide decreased from the 30th day before to the 15th day after parturition in the treated group. From the present study, it can be concluded that supplementation of dairy cattle by Celmanax, as an immunopotentiating factor, helps in improvement of the reproductive performance of the dairy cattle incorporation with the increase in the serum immune-stimulant responses of IgG / IgM and the decrease in the serum nitric oxide.

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1. INTRODUCTION

The transition period of a dairy cow was defined as the period of changing from the pregnant, non-lactating state to the non-pregnant, lactating state via an interval from three weeks prepartum to three weeks postpartum (Goff and Horst, 1997). Such period is indicated by the presence of numerous changes in the physiological, metabolic and endocrine statuses enough to accommodate parturition and lactogenesis (Grummer, 1995; Drackely, 1999). If nutritional management does not meet these challenges, the transition cow will be at risk in form of developing a wide range of health problems soon after parturition (Bell, 1995). These problems include retained placenta, metritis, postpartum anoestrus, milk fever, ketosis, and severely suppressed immune function (Grummer, 1995; Goff and Horst, 1997). It is of importance to notice that the proper management during the transition period (Fredeen et al., 1999; Rode, et al., 1999; Gordon, 2004) helps in responding the immune system (Rodrigues et al., 2000; Lowry et al., 2005; Chae et al., 2006), improving the reproductive performance,

decreasing the incidence of metabolic and infectious diseases and overcoming stress of milk production (Munro, 2000; Axford, 2001; Hsueh et al., 2010).

The present study is a trial to improve the reproductive performance of dairy cows following the oral supplementation of an immunostimulant prebiotic (Celmanax) drug prior to parturition.

2. MATERIALS AND METHODS

2.1. ANIMALS

A total number of 30 dairy cows, 3-8 years old and 1-6 parities, kept in a private farm in Dakahlia Governorate, were used in the current study during the period from January to December, 2012. Animals were offered to have the available daily ration which mainly consisted of ad lib barseem in winter and darawa in summer in addition to nearly 10 kg wheat straw and approximately 6 - 10 kg concentrate mixture. All cows were allowed a circular vaccination and deworming against the common epidemic and parasitic diseases.

Cows were divided randomly into two groups as follows: Group (1) of 20 cows was taken Celmanax R produced by Vi-Cor Co., USA, composed of mannan oligosaccharides, β -glucans, amino acids (glucoseamine, galactoseamine, alanine, arginine, aspartic acid, cystine, histidine, isoleucine, lysine, phenylalanine, proline, serine, threonine; tryptophane, tyrosine and valine) and minerals (calcium, copper, magnesium, manganese, phosphorus, potassium, sodium, sulfur and zinc) per os in a dose of 30 ml daily for two successive weeks started one month before the expected date of parturition. Group (2) of 10 cows was left without treatment as control.

All cows in both groups were put under continual observation immediately after calving to record normal dropping and retention of the foetal membrane from normal parturition. Cows suffered from retention of placenta were given the classical treatment including manual removal after 24 hours followed by intra-uterine administration of 4 gm Terramycin tablets produced by Pfizer Egypt Co., ARE, repeated day after day for three successive times. Complete uterine involution was estimated by rectal examination two times weekly. Days open period, number of services / conception and the conception rate were also recorded. Pregnancy was checked for all cows in both groups rectally after two months of service by proved fertile bull (s).

From each cow in both groups, on the 30 and 15 days before calving, day of calving and 15 days after calving, a blood sample of 10 ml/time was taken via the jugular vein in sterile blood collecting tubes. The blood samples were centrifuged at 3000 rpm for 20 min and the serum samples were stored at -20°C till chemical analysis of the serum IgG, IgM (Killingsworth and Savory, 1972) and the serum nitric oxide, NO (Rajaraman et al., 1998).

The obtained data were tabulated and statistically analyzed to estimate percentages, Mean $\pm$ S.E. and the analysis of variance according to (SPSS, 2007)

3. RESULTS

As shown from tables (1&2), the present study revealed a non-significant decrease in percentage of the retained fetal membrane (5 vs 20 %), a highly significant ($P < 0.01$) reduction in days of uterine involution (24.90 ± 0.46 vs 29.80 ± 0.85 days), non-

significant reduction in days open (66.00 ± 1.96 vs 75.30 ± 7.79 days) and number of service / conception (1.40 ± 0.13 vs 1.60 ± 0.22) incorporation with a non-significant increase in the conception rate (80.00 ± 9.18 vs $70.00 \pm 15.28\%$) for the treated vs the non-treated groups of dairy cattle.

In spite of the days of sampling, the present results (Table 3 and 4) revealed a highly significant ($P < 0.01$) increase in the serum IgG and IgM for the treated group (658.07 ± 5.17 & 37.74 ± 0.57 , respectively) more than that for the non-treated group (613.70 ± 7.34 & 30.56 ± 0.58 , respectively), contrary to that observed in case of the serum nitric oxide (6.81 ± 0.35 vs 8.12 ± 0.39).

Regarding the effect of celmanax, the current study indicated the presence of a remarkable increase in the serum IgG and IgM, 15 days after treatment and 15 days after parturition, it was (684.00 ± 7.00 & 675.80 ± 6.21) and (42.00 ± 0.50 & 39.77 ± 0.39) for IgG and IgM respectively more than that for the non-treated group it was (593.40 ± 6.70 & 634.00 ± 6.35) and (31.66 ± 0.27 & 30.58 ± 0.14) for IgG and IgM respectively, contrary to that observed in case of the serum nitric oxide, there was a significant decrease in the serum nitric oxide 15 days after treatment, at parturition and 15 days after parturition of cattle treated by Celmanax, it was (8.36 ± 0.10 & 5.15 ± 0.06 and 4.23 ± 0.04 respectively) less than non-treated group it was (9.99 ± 0.05 & 6.89 ± 0.21 and 6.08 ± 0.13 respectively) as shown in tables (3 and 4).

4. DISCUSSION

The transition period is a time of increased nutritional demands and risk to metabolic and infectious diseases in dairy cows due to a suppressed immune system (Bell, 1995; Goff and Horst, 1997; Huozha et al., 2010). The occurrence of health problems during the transition period is clearly a major complexed factor for subsequent reproductive performance (Grummer, 1995; Ferguson, 2001) resulting in additional economic losses, poor transitions also result in milk income losses. It has been noticed that the yeast culture supplementation significantly improves the reproductive ability, conception rate and fertility (Robinson, 1997; Abu El-Ella and Kommonna, 2013) as well as the immune response (Young, 2012).

Table 1. Reproductive performance for the post-parturient treated and control cows

Reproductive traits	Groups	
	Treated (20)	Non-treated (10)
Retained placenta (%)	1/20 (5.00%) ^a	2/10 (20.00%) ^a
Uterine involution (days)	24.90 ± 0.46 ^b	29.80 ± 00.85 ^a
Days open	66.00 ± 1.96 ^a	75.30 ± 07.97 ^a
Service/ conception	01.40 ± 0.13 ^a	01.60 ± 00.22 ^a
Conception rate (%)	80.00 ± 9.18 ^a	70.00 ± 15.28 ^a

Different letters within the same raw showed significance at least at $p < 0.05$. Each value represents Mean ± S.E

Table 2. Effect of celmanax on the reproductive performance of dairy cows.

Source of variance	Df	Retained placenta	Uterine involution	Days open Period	Service/ conception	Conception rate
Between groups	1	1500.000 ^{NS}	160.067 ⁺⁺	576.600 ^{NS}	0.267 ^{NS}	666.667 ^{NS}
Error	28	910.714	5.264	255.932	0.400	1892.857

Values are expressed in Mean Square; NS: Non-significant; ++: Significant at $P < 0.01$, Each value represents Mean ± S.E

Table 3. IgG, IgM (mg/dl) and NO (um/L) in treated and non-treated dairy cows in relation to time of calving

Time from calving	IgG	IgM	NO
<u>Treated group:</u>			
-30 days	647.50±8.78	33.46±0.29	9.51±0.08
-15 days	684.00±7.00	42.00±0.50	8.36±0.10
0 day	625.00±7.47	35.74±0.41	5.16±0.06
+15 days	675.80±6.21	39.77±0.39	4.23±0.04
Overall mean	658.07±5.17 ^a	37.74±0.57 ^a	6.81±0.35 ^b
<u>Non-treated group:</u>			
-30 days	649.00±5.79	33.40±0.20	9.53±0.04
-15 days	593.40±6.70	31.66±0.27	9.99±0.05
0 day	578.40±8.64	26.60±0.19	6.89±0.21
+15 days	634.00±6.35	30.58±0.14	6.08±0.13
Overall mean	613.70±7.34 ^b	30.56±0.58 ^b	8.12±0.39 ^a

Different letters within the same column showed significance at least at $p < 0.05$, Each value represents Mean ± S.E

Table 4. Change in IgG, IgM and nitric oxide in treated and non-treated groups of dairy cows in relation to time of calving

Source of variance	Df	IgG	IgM	Nitric oxide
Between groups (G)	1	26255.208 ⁺⁺	687.844 ⁺⁺	22.777 ⁺⁺
Between times (T)	3	7515.564 ⁺⁺	78.364 ⁺⁺	64.689 ⁺⁺
(G) x (T) interaction	3	4725.386 ⁺⁺	76.180 ⁺⁺	2.512 ⁺⁺
Error	52	455.702	1.204	0.063

Values are expressed in Mean Square ++: Significant at $P < 0.01$. Each value represents Mean ± S.E

The present study revealed a decrease in percentage of the retained foetal membrane after treatment of the dairy cattle by Celmanax (Table, 1), a finding which might be attributed to an immune-potentiating effect of Celmanax (Baines et al., 2011; young, 2012). This finding came in agreement with some previous reports (Nocek, 1994; Campbell et al., 1999).

Regarding the effect of Celmanax on other reproductive performance, there was a remarkable reduction in the time allowed for complete uterine involution for the treated more than for the non-treated dairy cows (Table,1), a finding which came in agreement with that obtained previously indicating the presence of a significant decrease in the time of

complete uterine involution after treatment of cattle by levamisole as an immunoestimulant drug (Eldesouky, 1997) and Celmanax as an immunopotentiating factor (Baines et al., 2011; Young, 2012). It has been reported that cattle supplementation by either the yeast culture (Laxmi et al., 2012) or Celmanax (Baines et al., 2011) helps in reduction of the degree of metritis and effects of some pathogenic bacteria.

In the present study, a non-remarkable shortness in the days open was observed in case of the treated when compared to the non-treated dairy cattle (Table, 1). This finding came in agreement with some previous studies referring that the calving - first service and calving - conception intervals were shorter in cattle supplemented by yeast culture than those nonsupplemented (Abdel-Khalek, 2003; Ibrahim, 2004; Komonna, 2007; Abdel-Rahman et al., 2012; Mousa et al., 2012; Ramosi et al., 2012). Such finding might be attributed either to stimulation of the immune system (Rodrigues et al., 2000; Young, 2012) or improvement of the health condition of the supplemented cows by yeast culture (Kalmus et al., 2009).

In the meantime, the present study showed a non-remarkable decline in number of service / conception for the treated when compared to that for the non-treated dairy cattle (Table, 1). This finding came in agreement with some previous studies referring to a decline in the number of service / conception and improvement in the conception rate associated with supplementation of dairy cattle either with yeast culture (Ramosi et al., 2012), trace mineral (Peralta et al., 2011) or amino acid chelates of Cu, Zn, and Mn (Bosseboeuf et al., 2006).

The present study indicated occurrence of a highly significant increase in rates of the serum IgG and IgM 2 week after treatment of cattle by Celmanax (table, 2), a finding which came in agreement with that reported in some previous investigations after dietary supplementation of mannan oligosaccharides in different species (Newman and Newman, 2001; O'Quinn et al., 2001; Franklin et al., 2002; Spearman, 2004). Increases in the level of both IgG and IgM two weeks after treatment and two weeks after parturition in treated cattle by Celmanax than non treated might be attributed to immunostimulating effect of Celmanax (Baines et al., 2011), but sudden decrease in the level of both IgG and IgM at parturition in treated and control group attributed to transport of immunoglobulin from blood into mammary gland secretion in the period

around calving (Mallard et al., 1998; Heriazon et al., 2011) which can be necessary for calf health.

On the other hand, there was a significant decrease in the serum nitric oxide two weeks after treatment, at parturition and two weeks after parturition of cattle treated by Celmanax (Table, 2), a finding which came in agreement with some previous studies (Piccinini et al., 2004; Huozha et al., 2010; Ibrahim, 2012). Decrease of serum nitric oxide in treatment group than control in the present study might be attributed either to the immunostimulating effect of Celmanax (Baines et al., 2011) or the highest level of nitric oxide around calving could exert an inhibitory effect on the immune function (Singh et al., 2011).

From the present study, it can be concluded that supplementation of dairy cattle by Celmanax, as an immunopotentiating factor, helps in reducing rate of placental retention, shortening time of uterine involution and days open, declining number of service/conception and improving the conception rate in association with the increase in the serum immune-stimulant responses of IgG / IgM and the decrease in the serum nitric oxide.

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